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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

8-6

February 21, 1997

To: Board of Directors (Engineering and Operations Committee--Action)
(Special Committee on Water Quality, Desalination,
and Environmental Compliance--Action)

From: *for* General Manager

Edward J. Meo III

Submitted by: Gary M. Snyder
Chief Engineer

Wayne Lee Beuhler for Snyder

Mark D. Beuhler
Director of Water Quality

Mark Beuhler

Subject: Policy Decision on the Oxidation Retrofit Program (ORP) at the Henry J. Mills
and Joseph Jensen Filtration Plants

RECOMMENDATION

That the Board direct the General Manager to proceed with the final design of ozone facilities at the Mills and Jensen plants, with scheduled on-line dates of late 2001 and late 2003, respectively, consistent with the Board's continuing commitment to public health and water quality.

DETAILED REPORT

The Board, member agency managers, and staff have been collaborating on a comprehensive water quality program to upgrade the region's water supply and proactively address future drinking water quality regulations. Under the Safe Drinking Water Act (SDWA), which was reauthorized six months ago, the U.S. Environmental Protection Agency (USEPA) expects to issue final regulations in November 1998, to be complied with by November 2001 (see Attachment No. 1). Agencies such as Metropolitan that plan to build major water quality facilities may receive a two-year extension to November 2003.

In anticipation of these events, Metropolitan has conducted research over the past 10 years to provide operational data to ensure that the USEPA's standard-setting process is

sound. This research has had three results: (1) the USEPA has dropped its proposal requiring granular activated carbon and allowed equally effective, less costly treatment improvements, saving Metropolitan more than \$2 billion; (2) heavy chemical addition (enhanced coagulation) has been eliminated as an alternative for Metropolitan in favor of the environmentally preferred ozone process; and (3) an optimized ozone process design has been achieved.

Water Quality Program. The addition of ozone facilities is part of a total water quality program, consisting of: source protection for both the State and Colorado River systems; facility upgrades (including a major water quality laboratory expansion); process optimization (e.g., USEPA/water industry partnership to improve turbidity and *Cryptosporidium* removal); water quality monitoring (includes partnership with the California Department of Water Resources to monitor State project water for *Cryptosporidium*); and research on emerging issues such as MTBE, *Cryptosporidium*, and Colorado River water salt removal. The goal of the oxidation retrofit program is to improve the region's water quality by applying a new cost-effective treatment strategy that anticipates the public perception of health, as well as drinking water quality regulations. Source protection is as vital as treatment in a comprehensive water quality program. To that end, Metropolitan and its member agencies are active participants in source protection programs, and were directly involved in developing strong source protection language in the 1996 SDWA amendments.

Rate Management and Cost Containment. Metropolitan and its member agencies are committed to assuring a safe and reliable water supply. Additionally, the agencies have a fiduciary responsibility to their constituents to manage rates and contain costs. It has been agreed in numerous forums that Metropolitan's capital improvement program, including ozone, is bound by the Phase 1 rate management objectives adopted by the Board in July 1996. Under these objectives, the treated water rate is not to exceed a 1.5 percent annual increase in 1998 and 1999, and a 2.0 percent annual increase in 2000 and 2001, including ozone costs. Four alternatives for implementing ozone that will ensure compliance with anticipated regulations are discussed in this letter (see Table 1 and Attachment No. 1). All four alternatives are well within the rate management objectives (see Figures 1 and 2).

Implementation Schedule. Both Board members and member agency managers have pointed out the importance of the implementing schedule with respect to four decision-making factors. First, USEPA's final rules will not be published for 18 months, until November 1998. It is preferable to not undertake major capital investments before the rules are issued. This will allow an additional year or so to take advantage of technical improvements or price breakthroughs in ozone technology. Second, research on *Cryptosporidium* should be completed by July 1998, for timely input to ozone design. Third, the Board must retain discretion regarding the equipment purchase in order to responsively address water quality or health concerns arising within our six-county service area. Fourth, scheduling allows time to thoroughly evaluate the treatment surcharge agreed to as part of the Phase 1 rate refinement process.

Recommended Alternative. While each of the first three alternatives presented address the four decision-making factors noted above, the alternative which best meets all of these considerations is Alternative No. 4, the “flexible implementation” option. Specifically, it does the following: (1) maintains the region’s leadership on water quality through prudent on-line scheduling for the Mills and Jensen ozone facilities; (2) allows final regulatory requirements to be incorporated into the construction decision; (3) provides the flexibility to perform needed research as input to the design process; (4) acknowledges the Board’s discretion to accelerate construction if required by regional health considerations; and (5) provides reasonable rate management and leverages experience through sequential design and use of commercially-available liquid oxygen in place of new oxygen-separation equipment. In a related matter, it is suggested that a participatory process be utilized to undertake a review of the treated water surcharge to acknowledge the regional benefits of water quality.

Next Steps. Staff plans to return to the Board by July 1998 to present results of the *Cryptosporidium* Action Plan, including information on treatment optimization, and the required ozone dosage to control *Cryptosporidium*. In the interim, staff will provide regular updates on regulatory developments and other events as appropriate. This action is exempt from CEQA.

JTG/FWH/mi

Attachments

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TABLE 1

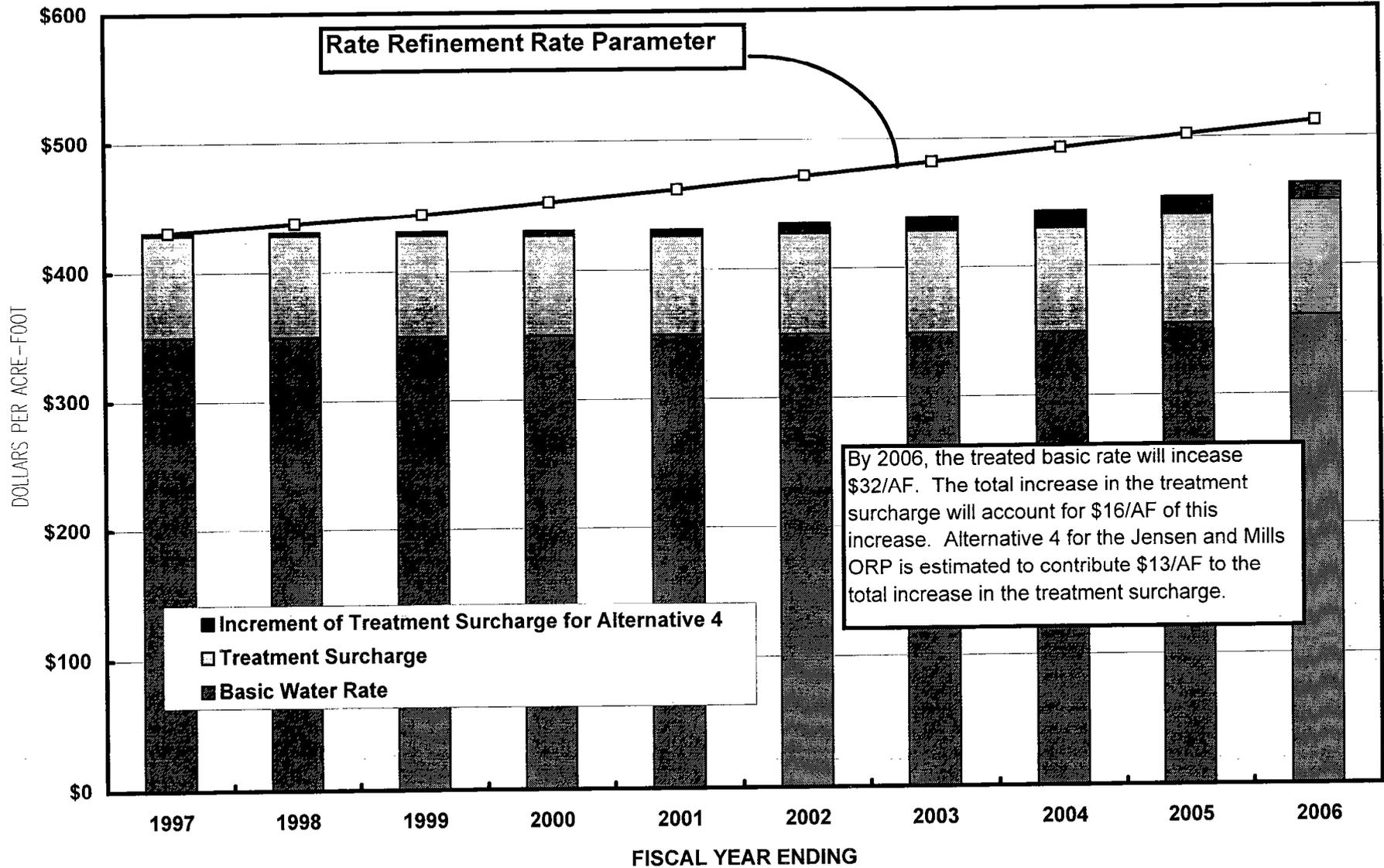
JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
IMPLEMENTATION ALTERNATIVES

ALT.	APPROACH	DESCRIPTION
1	Extended Schedule	<ul style="list-style-type: none"> • Reinvigorate Design Effort Now • Design Plants Sequentially • No Equipment Purchase Now; Rebid Ozone/Oxygen Equipment Contract and Award after Promulgation of Stage 1 of D/DBP Rule and IESWTR (November 1998) • Parallel Construction for Mills and Jensen • On-Line Dates: Late 2003 for Mills Late 2003 for Jensen
2	Stop and Wait	<ul style="list-style-type: none"> • Rebuild Two Design Teams and Reinitiate Design Effort after Promulgation of Stage 1 of D/DBP Rule and IESWTR (November 1998) • Parallel Design/Construction for Jensen and Mills • No Equipment Purchase Now; Rebid and Award Ozone/Oxygen Equipment Contract after November 1998 • On-Line Dates: Late 2003 for Mills Late 2003 for Jensen
3	Earliest On-Line	<ul style="list-style-type: none"> • Reinvigorate Design Effort Now • Parallel Design/Construction for Jensen and Mills • Rebid and Award Ozone/Oxygen Equipment Now • On-Line Dates: Late 2001 for Mills Late 2002 for Jensen
4	Flexible Implementation	<ul style="list-style-type: none"> • Reinvigorate Design Effort Now • Design Plants Sequentially • No Equipment Purchase Now; Rebid Equipment and Award after Promulgation of Stage 1 of D/DBP Rule and IESWTR (November 1998) • On-Line Dates: Late 2001 for Mills (LOX) Late 2003 for Jensen

Figure 1. Comparison of Ozone Implementation Alternatives

	Alternatives			
	1. Extended Schedule	2. Stop and Wait	3. Earliest Online	4. Flexible Implemen- tation
Compliance with anticipated regulations	Yes	Yes	Yes	Yes
Schedules equipment purchase to incorporate any changes in regulations and technology	✓	✓	—	✓
Most responsive to public health consideration	*	*	***	**
Online dates Mills Jensen	Nov. 2003 Nov. 2003	Nov. 2003 Nov. 2003	Nov. 2001 Nov. 2002	Nov. 2001 Nov. 2003
Rate management benefits (cost per ac-ft) Year 2000 Year 2005 and beyond	\$4 \$13	\$4 \$13	\$6 \$12	\$4 \$13

**FIGURE 2
TREATED BASIC RATE AND
RATE REFINEMENT RATE PARAMETER
ALTERNATIVE 4 - JENSEN AND MILLS ORP**



ATTACHMENT NO. 1

TECHNICAL INFORMATION DOCUMENT UPDATE

The Board, member agency managers, and staff have been collaborating on a comprehensive water quality program to upgrade the region's water supply, and proactively address future drinking water quality regulations. The addition of ozone facilities is part of a total water quality program, consisting of: source protection for both the State and Colorado River systems; facility upgrades (including a major water quality laboratory expansion); process optimization (e.g., the USEPA/water industry partnership to improve turbidity and *Cryptosporidium* removal); water quality monitoring (including the partnership with the California Department of Water Resources to monitor State project water (SPW) for *Cryptosporidium*; and research on emerging issues such as MTBE, *Cryptosporidium*, and TDS control in Colorado River water (CRW).

Attachment A outlines the chronology of events associated with the Jensen and Mills ORP, including regulatory developments and Board decisions. One important event, a Board workshop on the Jensen and Mills ORP, was held on December 2, 1996. Answers to key questions raised during the workshop are presented in Attachment B.

Regulatory Schedule. Under the authority of the Safe Drinking Water Act (SDWA) amendments of 1996, the U.S. Environmental Protection Agency (USEPA) is now planning to promulgate Stage 1 of the proposed D/DBP Rule and the Interim Enhanced Surface Water Treatment Rule (IESWTR) in November 1998. During the past several months, members of the drinking water industry (including Metropolitan staff), the environmental community, consumer groups, and other regulatory agencies have been meeting with the USEPA to discuss which parts of these proposed regulations can and should be promulgated in 1998, given that the data from the Information Collection Rule (ICR) is not available. The drinking water industry is particularly concerned about the potential for increasing microbial risk by decreasing disinfectant concentrations to reduce DBP formation, without adequate microbial occurrence data in source waters.

Since the above discussions are going well and are nearing consensus, the USEPA is in the process of reinitiating negotiations to modify the Stage 1 requirements to ensure that microbial risks are not increased. The USEPA is confident that the revised regulations (Stage 1 of the D/DBP Rule and the IESWTR) will be ready for promulgation in November 1998. Stage 1 of the D/DBP Rule is still envisioned as a treatment requirement (enhanced coagulation or ozone), and maximum contaminant levels (MCLs) for specific DBPs (trihalomethanes--THMs and haloacetic acids--HAAs). Accordingly, modifications to the SPW plants (Mills and Jensen) will still be required under a modified Stage 1.

The 1996 SDWA amendments also increased the time-frame for compliance from 18 months to 3-5 years. Based on promulgation in November 1998, utilities will be required to comply with the regulations by November 2001-2003, depending upon the need for capital improvements. Staff have assumed Metropolitan would qualify for the two-year extension for the construction of new capital facilities, and therefore, has a maximum of five years to comply from the date of promulgation (November 2003 compliance).

Ozone Implementation Alternatives. Metropolitan staff have identified four viable implementation alternatives for the Mills and Jensen ozone facilities. Each of these alternatives will ensure that Metropolitan and its member agencies will comply with Stage 1 of the D/DBP Rule by November 2003 as required, and are consistent with the rate objectives developed during the rate refinement process. Table 1 provides descriptions of the alternatives, while Figure 1 compares the alternatives on the basis of flexibility, responsiveness to health considerations, and cost. Figure 2 illustrates that all four alternatives fall within the rate envelope agreed to during the Phase 1 rate refinement process. The first three alternatives were discussed previously in the "Ozone Technical Information Document," which was attached to the August 27, 1996, Board letter entitled "Scheduling and Implementation of the Inland Feeder Project, Lake Mathews Outlet Facilities Project, and the Ozone Retrofit Project." The fourth alternative was recently developed to incorporate the best of all options.

Staff Recommendation. Metropolitan staff have been evaluating ozone for approximately ten years, including five years of testing at the 5.5-million-gallon-per-day oxidation demonstration project. Based on this experience and a thorough understanding of the regulations, staff believe that the most-cost effective strategy for complying with Stage 1 of the proposed D/DBP Rule at the SPW plants (Mills and Jensen) is to switch the primary disinfectant from chlorine to ozone. In addition to reducing the formation of DBPs, ozone is the most effective disinfectant against pathogens, such as *Cryptosporidium*, and can remove earthy/musty tastes and odors associated with periodic algal growth in source-water reservoirs. Consequently, ozone represents a long-term treatment strategy that will assist Metropolitan in achieving its goal of providing safe, aesthetically-pleasing drinking water to its consumers and protecting public health.

Therefore, staff recommends that final design of the Mills and Jensen ozone facilities proceed sequentially (Alternative No. 4 in Table 1), with on-line dates of late 2001 and late 2003, respectively. Alternative No. 4 involves reinvigorating the design effort, and awarding an equipment contract after Stage 1 of the proposed D/DBP Rule and the IESWTR are finalized in November 1998. This alternative differs from the others in that commercially-available, liquid oxygen can initially be used in place of a new oxygen-separation system, substantially simplifying design. An equipment substitution is possible due to the low demands projected through the year 2010. As a result, staff can complete design of the Mills ozone retrofit prior to purchasing equipment in late 1998.

Advantages of Recommended Alternative. The recommended alternative (Alternative No. 4), which postpones the equipment purchase until late 1998, affords Metropolitan staff additional time to incorporate into the design any potential changes in the regulatory requirements, technology improvements, and results of ongoing research on the ozone dosage required for *Cryptosporidium* inactivation. In addition, sequential design controls costs and improves design efficiencies, since portions of the Mills design can be applied to the Jensen design. This alternative will also give staff the opportunity to conduct a thorough review of the treatment surcharge to determine if some cost components should be legitimately shifted to the basic water charges. The recommended alternative acknowledges the Board's discretion to accelerate construction if required by regional health considerations. Finally, this alternative maintains the region's leadership on water quality.

TABLE 1

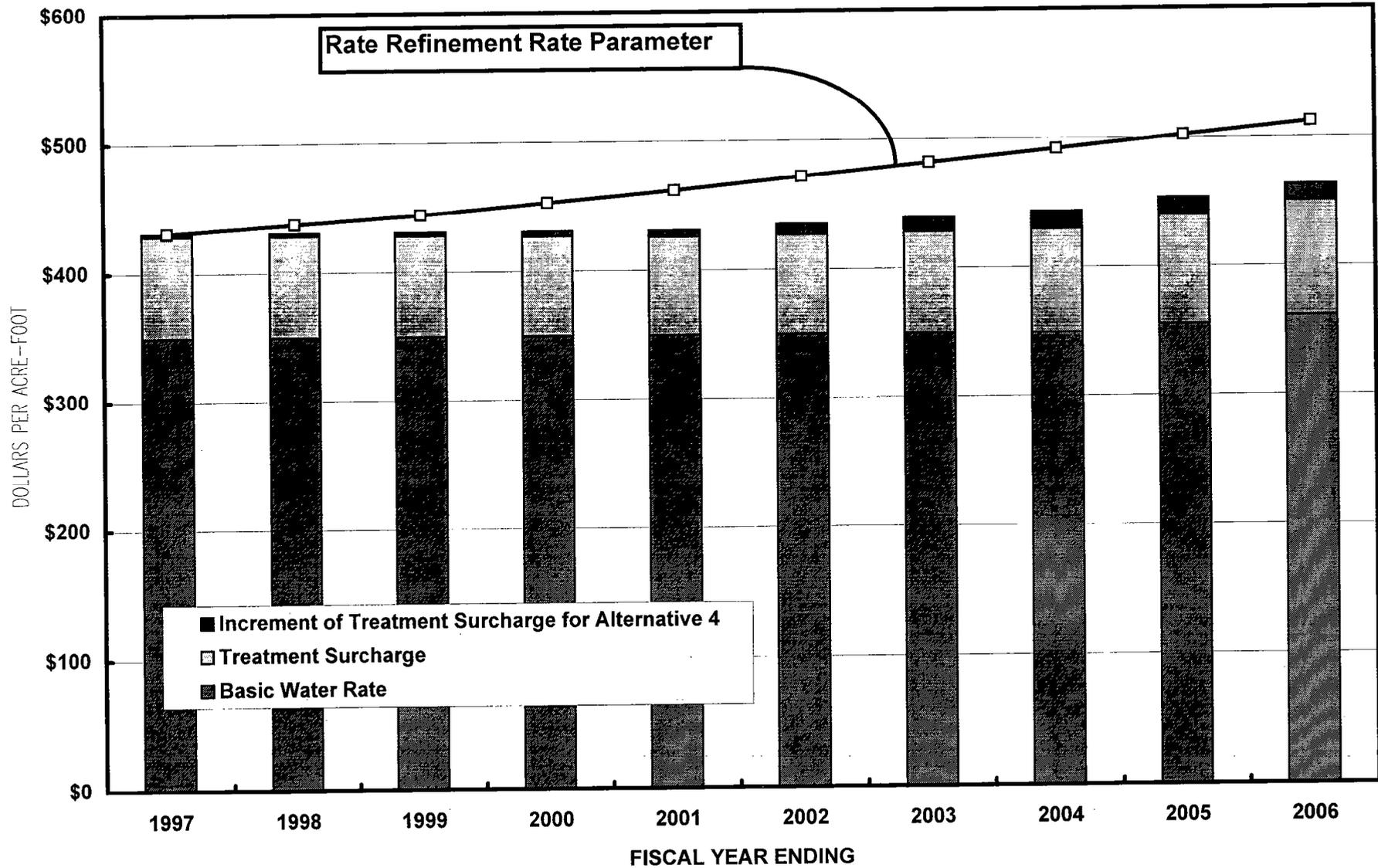
JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
IMPLEMENTATION ALTERNATIVES

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Most responsive to public health consideration	*	*	***	**
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**FIGURE 2
TREATED BASIC RATE AND
RATE REFINEMENT RATE PARAMETER
ALTERNATIVE 4 - JENSEN AND MILLS ORP**



ATTACHMENT A

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP) **CHRONOLOGY** (1979-1997)

<u>DATE</u>	<u>ACTIVITY</u>
1979	Trihalomethane (THM) standard set at 100 µg/L.
July 1984	Metropolitan switched secondary disinfectant from free chlorine to chloramines to reduce THM formation.
April 1986	Metropolitan THM Action Plan presented to Board.
June 1986	President Reagan signed the Safe Drinking Water Act (SDWA) Amendments of 1986 into law. USEPA announced plans to significantly lower the THM standard.
July 1987	Board approved \$2.9 million (Appropriation No. 536) to fund bench- and pilot-scale studies on granular activated carbon and oxidants (including ozone) under the THM Action Plan.
June 1988	Board approved first increase in Appropriation No. 536 of \$800,000 to finance an evaluation of the feasibility of the Oxidation Demonstration Project (ODP) as the next step of the THM Action Plan.
January 1989	Board approved second increase in Appropriation No. 536 of \$4.2 million to finance the design of the ODP.
October 1989	USEPA released "Strawman" (or draft) THM standard of either 25 or 50 µg/L.
March 1990	Board approved third increase in Appropriation No. 536 of \$13.3 million to finance the construction of the ODP.
September 1990	Board approved fourth increase in Appropriation No. 536 of \$100,000 to fund bromide/brominated disinfection by-product (DBP) bench-scale studies.
September 1990	Board approved \$5 million (Appropriation No. 610) for Oxidation Retrofit Program (ORP) preliminary investigations at all five plants.

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
CHRONOLOGY (continued)
(1979-1997)

<u>DATE</u>	<u>ACTIVITY</u>
January 1991	Information Board letter on USEPA shift in its regulatory philosophy for developing DBP regulations by seeking to balance DBP and microbial risks.
March 1991	Board approved fifth increase in Appropriation No. 536 of \$1.7 million to finance the operations phase of the ODP.
February 1992	Testing began at Metropolitan's ODP to confirm the effectiveness of the ozone and PEROXONE (the combination of hydrogen peroxide and ozone) processes for controlling DBP formation, microorganisms, and taste-and-odor compounds.
September 1992	USEPA initiated negotiations on DBP and microbial regulations with drinking water industry, environmental community, consumer groups, and other regulatory agencies.
May 1993	Tentative agreement on DBP Rule cluster reached between negotiators. The cluster included: Stages 1 and 2 of the Disinfectants/Disinfection By-Products (D/DBP) Rule; the Enhanced Surface Water Treatment Rule (ESWTR); and the Information Collection Rule (ICR). ODP data on enhanced coagulation and bromate formation/control used by negotiators.
June 1993	Board approved \$9,265,400 (Appropriation No. 659) to finance an additional three years of ODP operations.
August 1993	Information Board letter, "Overview of Metropolitan's Oxidation Retrofit Program," presented with the Ozone/PEROXONE Decision Document attached. Staff stated need for Board commitment to ORP at all five plants and sedimentation basins at Skinner by September 1993 to ensure compliance by June 1998. ORP preliminary investigations estimated ozone retrofit costs at \$725 million for all five plants.
October 1993	Staff from Los Angeles Department of Water and Power (LADWP) suggested a water exchange between the L.A. Aqueduct Filtration Plant (LAAFP) and Jensen as a potential strategy to meet regulations and defer capital costs.

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
CHRONOLOGY (continued)
(1979-1997)

<u>DATE</u>	<u>ACTIVITY</u>
November 1993	Board approved increase in Appropriation No. 610 from \$5 to \$14.1 million for preliminary design at Jensen and Mills, and environmental documentation at Jensen. Cost estimate of \$725 million scaled back to \$575 million by considering D/DBP Rule compliance only and reducing the design ozone dosage from 3 to 2 mg/L. Based on Board and member agency comments, as well as the Engineering and Operations Peer Review Group findings regarding ORP capital costs, staff were requested to thoroughly evaluate the proposed water exchange and reevaluate enhanced coagulation.
June 1994	Information Board letter presented on the LADWP/Metropolitan water exchange proposal. A joint LADWP/Metropolitan committee evaluated the water exchange and enhanced coagulation, with input from affected member agencies. The water exchange proposal was not economically feasible, and ozone was confirmed to have a lower overall cost compared to enhanced coagulation. Therefore, staff stated need for Board decision on Jensen and Mills ORP by August 1994 to ensure compliance with Stage 1 of the D/DBP Rule. Decisions on the need for ozone at the plants treating Colorado River water (Skinner, Weymouth, and Diemer) could be deferred at least one year.
June 29, 1994	Proposed DBP Rule cluster (Stages 1 and 2 of the D/DBP Rule, Interim ESWTR, and ICR) published in the Federal Register, with a compliance date of June 1998.
August 1994	Board approved second increase in Appropriation No. 610 of \$24 million to finance final design of Jensen and Mills ORP. Capital costs estimated at \$127 million for Jensen and \$73 million for Mills (total of \$200 million), with on-line dates of June 1998 for both plants.
April 1995	Board approved third increase in Appropriation No. 610 of \$10 million to finance site preparation for Jensen ORP.
November 1995	Process design criteria for Jensen and Mills ORP finalized.

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
CHRONOLOGY (continued)
(1979-1997)

<u>DATE</u>	<u>ACTIVITY</u>
December 1995	Request for bids on the ozone/oxygen equipment package for the Jensen and Mills ORP was advertised.
January 1996	Oral report on Jensen and Mills ORP was given to the Special Committee on Water Quality and Environmental Compliance (SCOWQEC). Staff were asked to develop additional information and costs on alternative compliance strategies.
February 7, 1996	Bids on the ozone/oxygen equipment package were opened.
April 30, 1996	Rate refinement/cost containment review group meeting held with member agency managers. Staff were asked to revise the 1993/94 cost estimates (completed as part of the LADWP/Metropolitan water exchange evaluation) for alternatives to ozone, as well as explore other novel approaches, given draft SDWA language extending the compliance timeframe and reduced demand projections.
June 1996	Draft Board letter for fourth increase in Appropriation No. 610 of \$29 million for procurement of ozone/oxygen equipment .
June 1996	USEPA announced further delays in promulgating the DBP Rule cluster from original 1996 date to the year 2000 at the National American Water Works Association (AWWA) Conference, due to delays in the ICR finalization.
July 1996	Temporary employees and consultants working on the ORP were terminated to reduce the program expenditures until Board could make a decision on the ORP implementation schedule.
July 23, 1996	Presentation made to SCOWQEC on delaying implementation of ozone at Jensen and Mills to defer costs, based on cost containment efforts. Committee requested that staff bring letter to the SCOWQEC for action in August 1996, prior to full Board action scheduled for September 1996.

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP)
CHRONOLOGY (continued)
(1979-1997)

<u>DATE</u>	<u>ACTIVITY</u>
August 6, 1996	President Clinton signed the SDWA amendments of 1996 into law, extending the compliance timeframe from 18-months to 3-5 years. Based on SDWA reauthorization, the USEPA plans to promulgate Stage 1 of the D/DBP Rule and the Interim ESWTR in November 1998.
August 27, 1996	Board letter to SCOWQEC with Ozone Technical Information Document attached (includes July/August 1996 staff evaluation to look at options to take full advantage of regulatory schedule flexibility afforded by the SDWA reauthorization and reduced demand projections). Requested the committee reaffirm its commitment to ozone and direct staff to proceed with the Extended Schedule/Full Capacity option, which had the lowest present value and the greatest number of benefits, with on-line dates of 2004 for Jensen and Mills. Staff recommendation was approved by the committee.
August 29, 1996	Rate refinement process/cost containment review group meeting with member agency managers, where ORP implementation options were presented. Managers supported shutting the design down because of concerns related to costs and being out front of regulations.
September 1996	ORP pulled from letter to Board on cost containment effort, which also included Inland Feeder and Lake Mathews Outlet Tower, due controversy concerning continuing the design efforts.
December 2, 1996	Board Workshop on ORP and Body Contact Recreation.
January 1997	Presentation to the Special Committee on Water Quality, Desalination, and Environmental Compliance (SCOWQDEC) on questions and answers from the Board Workshop, as well as staff intent to bring recommendation on ORP implementation to March 1997 meeting.
February 1997	Member agency managers suggested continuing forward with design of Jensen and Mills ORP, as long as no capital expenditures are made in advance of promulgation of Stage 1 of D/DBP Rule and Interim ESWTR in November 1998.

ATTACHMENT B

JENSEN AND MILLS OXIDATION RETROFIT PROGRAM (ORP) **BOARD WORKSHOP QUESTIONS AND ANSWERS**

December 2, 1996

Key questions from the Board Workshop on the Jensen and Mills ORP, held on December 2, 1996, are answered below. Copies of the overheads presented at the workshop were mailed to all board members, and are available upon request.

1. *What is the current regulatory schedule?*

The USEPA is now planning on promulgating Stage 1 of the Disinfectants/Disinfection By-Products (D/DBP) Rule and the Interim Enhanced Surface Water Treatment Rule (IESWTR) in November 1998. The USEPA is under a great deal of pressure from the consent decree with the Bull Run Coalition to get a regulation implemented. Members of the drinking water industry (including Metropolitan staff) the environmental community, consumer groups, and other regulatory agencies have been meeting with the USEPA to discuss which parts of the proposed regulations can and should be promulgated in 1998, given that data from the Information Collection Rule (ICR) are not available. The water industry is particularly concerned about the potential for increasing microbial risk by decreasing disinfectant concentrations to reduce DBP formation, without adequate microbial occurrence data in source waters. Based on promulgation in November 1998, utilities will be required to comply with the regulations by November 2001-2003, depending upon the need for capital improvements. Staff have assumed Metropolitan would qualify for the two-year extension for the construction of new capital facilities, and therefore, has five years for compliance from the date of promulgation (November 2003 compliance).

2. *When do we have to make a decision to move forward with design for an on-line date of November 2003, if we halt the design effort now?*

In order to ensure compliance by November 2003, staff would require approval to proceed with design as soon as the regulations are promulgated in November 1998. This would allow for rebuilding the design team, bidding and awarding consulting and construction contracts, purchasing equipment, etc.

3. *What is the earliest date by which the Jensen and Mills ozone facilities could be on-line?*

If we started now and utilized two design teams working in parallel, we could have the facilities on-line by 2002.

4. *How would technological breakthroughs affect the usefulness of the design? Is there a potential that the equipment will become outdated? Will there be technological breakthroughs that we can't take advantage of if we proceed with design?*

Staff have discussed the possibility of technological breakthroughs with all of the major manufacturers of ozone and oxygen equipment. According to them, major advances in technology are not foreseen in the next decade. Although there may be slight improvements in equipment efficiency, the manufacturers have stated that they will install the latest technology at Metropolitan's plants.

5. *Is ozone effective against Cryptosporidium? Have we seen enough Cryptosporidium to measure disinfection effectiveness in our ozone testing? What dosage is necessary to achieve Cryptosporidium inactivation?*

While we have not seeded Metropolitan's pilot plant with Cryptosporidium to determine disinfection effectiveness in our waters, several researchers have demonstrated that ozone is much more effective than free chlorine for Cryptosporidium inactivation. According to the literature, the current design ozone dosage of 2 mg/L would result in a Cryptosporidium reduction of approximately 0.2 log (or 37 percent). Ozone dosages of 3 and 4 mg/L would yield 0.5 log (70 percent) and 1.0 log (90 percent) inactivation of Cryptosporidium, respectively. By comparison, free chlorine provides no Cryptosporidium inactivation. In November 1996, Montgomery Watson released the latest results of their evaluation of Cryptosporidium inactivation by ozone in Colorado River water. Their study observed that 3 mg/L of ozone will result in 1.0 log-inactivation (90 percent) of Cryptosporidium. Since we will likely receive credit for a 2.5-log reduction of Cryptosporidium through conventional treatment, we would need to obtain an additional 0.5 to 1.0 log reduction by ozone. Montgomery Watson will study ozone inactivation of Cryptosporidium in State project water in the project's next phase. Finally, the USEPA has indicated that it is considering defining Best Available Technology (BAT) for Cryptosporidium inactivation as ozone.

6. *Why are we designing for an ozone dosage of 2 mg/L if it isn't sufficient to inactivate Cryptosporidium?*

Ozone was recommended for implementation at Metropolitan's filtration plants to control THM levels and comply with future DBP regulations. Staff initially recommended an ozone dosage of 3 mg/L to remove tastes and odors, and control microorganisms, as well as reduce DBP formation. In 1993, the ozone dosage was reduced from 3 to 2 mg/L to comply with DBP MCLs only, and reduce overall program costs.

Based on the current demand projections through the year 2010, the ozone/oxygen equipment for a design ozone dosage of 2 mg/L at the plants' design capacities (750 MGD at Jensen and 326 MGD at Mills) will be capable of achieving ozone dosages

greater than 3 mg/L at those lower projected flows. Average flows for a normal year in 2010 are projected at 305 MGD at Jensen and 122 MGD at Mills. In addition, the initial ORP facilities will be designed and constructed to be readily expandable to a higher design ozone dosage (e.g., 3 mg/L) by adding additional ozone/oxygen equipment when required by regulations or increased demand projections.

7. *What is the cost to add ozone generation capacity at Jensen and Mills to increase the ozone dosage to 3 or 4 mg/L from 2 mg/L for Cryptosporidium inactivation?*

Attachment No. 1 presents the estimated costs (capital and O&M) for design ozone dosages ranging from 2 to 5 mg/L for both Jensen (750 MGD) and Mills (326 MGD). These cost estimates were derived from a cost estimating model that was created in 1994 by Montgomery Watson under contract with Metropolitan's Engineering Division. The model uses actual data obtained from ozone plants that were constructed prior to 1994. The cost estimates were then escalated to the year 2004, the anticipated on-line date for ozone facilities at Jensen and Mills. Annual O&M costs are based on average flow rates projected for the year 2010 (305 MGD at Jensen and 122 MGD at Mills). Based on the model, increasing the ozone dosage from 2 to 3 mg/L would increase the capital costs by \$37.5 million at Jensen and \$14.9 million at Mills; the total capital cost increase is estimated at \$52.4 million. In 1997 dollars, the estimated costs are \$26.6 and \$10.6 million for Jensen and Mills, respectively.

8. *How long would it take to expand the ORP in the future to increase the dosage from 2 mg/L to something higher?*

Approximately 3 years, following board approval, to design and construct the expanded facilities.

9. *Is it necessary to rely solely on ozone for controlling Cryptosporidium?*

Cryptosporidium is controlled in drinking water through physical removal (conventional filtration) and inactivation by disinfection. We would remove approximately 2.5 log of Cryptosporidium through conventional treatment and 0.5-1.0 log by ozone disinfection. (see Question #5).

10. *Do we have a Cryptosporidium problem in our waters?*

The three-year Cryptosporidium Action Plan was designed to answer this question. We are currently half way through the project. Although levels of Cryptosporidium have generally been low, we have seen spikes in the influent to the Jensen and Mills plants. In addition, it is not known whether or not these organisms are viable (i.e., capable of causing disease). However, since there is not presently a Cryptosporidium regulation, the significance of these data are unclear at this time.

11. *Will Cryptosporidium build up resistance to ozone with time?*

No. Unlike antibiotics, ozone is very non-selective and attacks Cryptosporidium at many different sites. Therefore, you will not see an increase in resistance over time.

12. *What are the future demand projections that were used to determine rate impacts by ozone?*

The demand projections used to determine ORP rate impacts were developed as part of the rate refinement process. These projections were lowered from the IRP forecast to account for slower population growth. In the current year, treated sales are expected to total 1.22 million acre-feet, or approximately 71 percent of an expected total sales level of 1.71 million acre-feet. By year 2005, when the Jensen and Mills ozone facilities would be completed, treated sales are expected to increase 11 percent or 0.14 million acre-feet to 1.36 million acre-feet. The following table summarizes the sales projections used to determine the rate impacts of ozone.

	Total Sales (Millions of Acre-Feet)		
	<u>Treated</u>	<u>Untreated</u>	<u>Total</u>
1996-97	1.22	0.49	1.71
1999-00	1.25	0.68	1.93
2004-05	1.36	0.75	2.11
2009-10	1.45	0.82	2.27
2019-20	1.69	0.96	2.65

13. *How would ozone affect rates if the future demand projections are further reduced?*

If treated water sales increase as shown in the above table, the incremental cost of the Extended Schedule/Full Capacity option for the Jensen and Mills ORP will increase the average cost of treated water by \$12/acre-foot by the year 2005. If treated water sales do not increase from their current level, the same program will result in a \$13/acre-foot increase in the average cost of treated water. Although lower treated water sales increase the average unit cost of the Jensen and Mills ORP by \$1/acre-foot, it is important to recognize that because of other fixed treated water costs, lower sales would increase the treatment surcharge by approximately \$12/acre-foot.

14. *Is it true that the State Revolving Loan Fund (SRF) might be used for planning and not for construction?*

No. The State of California is slated to get \$75 million from the first year's authorization and it is primarily aimed at the construction of new facilities. Although the state has the option to use pieces of it for other purposes, such as small water treatment systems and source protection, the primary purpose is building new treatment facilities across the country.

15. How are SRF monies an advantage of the ORP extended schedule?

We will likely have a much stronger case for obtaining SRF monies if we are proceeding with implementing ozone. If we stop the design efforts entirely, it will be very difficult to make the case that we have a commitment to constructing ozone facilities.

16. Why is there a discrepancy between the total treatment surcharges and the ozone treatment surcharges for the different options? Why don't they add up?

The total treatment surcharge and the "ozone surcharge" are not directly comparable. The total treatment surcharge shown in Attachment No. 2 (page 22 from the presentation overheads) is lower than it otherwise would be due to the use of the treatment surcharge stabilization fund. The ozone surcharges were calculated as simple averages (total increase divided by treated water sales) and do not account for the use of the treatment surcharge fund.

17. Do the ORP implementation options fit within the rate parameters established by Phase 1 of the rate refinement process?

Yes. All implementation options fall within the rate envelope agreed to during Phase 1 of the rate refinement process. Under the agreement, Metropolitan has committed to not increase the treated water rate by more than 1.5 percent in 1998 and 1999, and 2.0 percent in 2000 and 2001.

18. Should the entire cost for ozone be borne by the treatment surcharge?

Currently, all of the capital and direct operating and maintenance costs necessary to provide treated water are recovered through the treatment surcharge (including treated seasonal and agricultural deliveries). The ORP is necessary to meet new drinking water standards and, under current policy, would be recovered through the treatment surcharge. Some board members and member agency managers have observed that the ORP may provide more general benefits to all users. At the Board's direction, staff will evaluate any benefits of additional operating flexibility that may result from the Jensen and Mills ORP and consider how these benefits may affect the current treatment surcharge.

Attachment 1

Oxidation Retrofit Program

Estimated Costs

Plant	Design Ozone Dose (mg/L)	Estimated Cryptosporidium Inactivation log (%)	Total Estimated Capital Cost (\$M)	Total Estimated Annual O & M Cost (\$M/yr.)
Jensen (750 MGD)	2	0.2 (36.9)	\$ 127.0 M	\$ 4.2 M/yr.
	3	0.5 (68.4)	164.5	5.9
	4	1.0 (90.0)	193.9	7.3
	4.5	1.5 (96.8)	203.8	8.3
	5	2.0 (99.0)	211.0	10.1
Mills (326 MGD)	2	0.2 (36.9)	73.0	1.7
	3	0.5 (68.4)	87.9	2.0
	4	1.0 (90.0)	98.1	2.8
	4.5	1.5 (96.8)	101.7	3.0
	5	2.0 (99.0)	107.7	3.2

Notes: On-Line Date - 2004

Capital Cost Include Escalation at 5% to 2004

Jensen and Mills ORP

Impacts on the Treatment Surcharge

	Treatment Surcharge (\$/acre-foot)					
	Year					
	2000		2005		2010	
	Total	Ozone	Total	Ozone	Total	Ozone
Implementation Options:						
Baseline	\$85	\$11	\$93	\$11	\$114	\$11
Stop/Retart	\$82	\$4	\$100	\$13	\$119	\$13
Extended Schedule/ Full Capacity	\$82	\$4	\$99	\$12	\$118	\$12
Extended Schedule/ StagedCapacity	\$82	\$4	\$97	\$11	\$121	\$14